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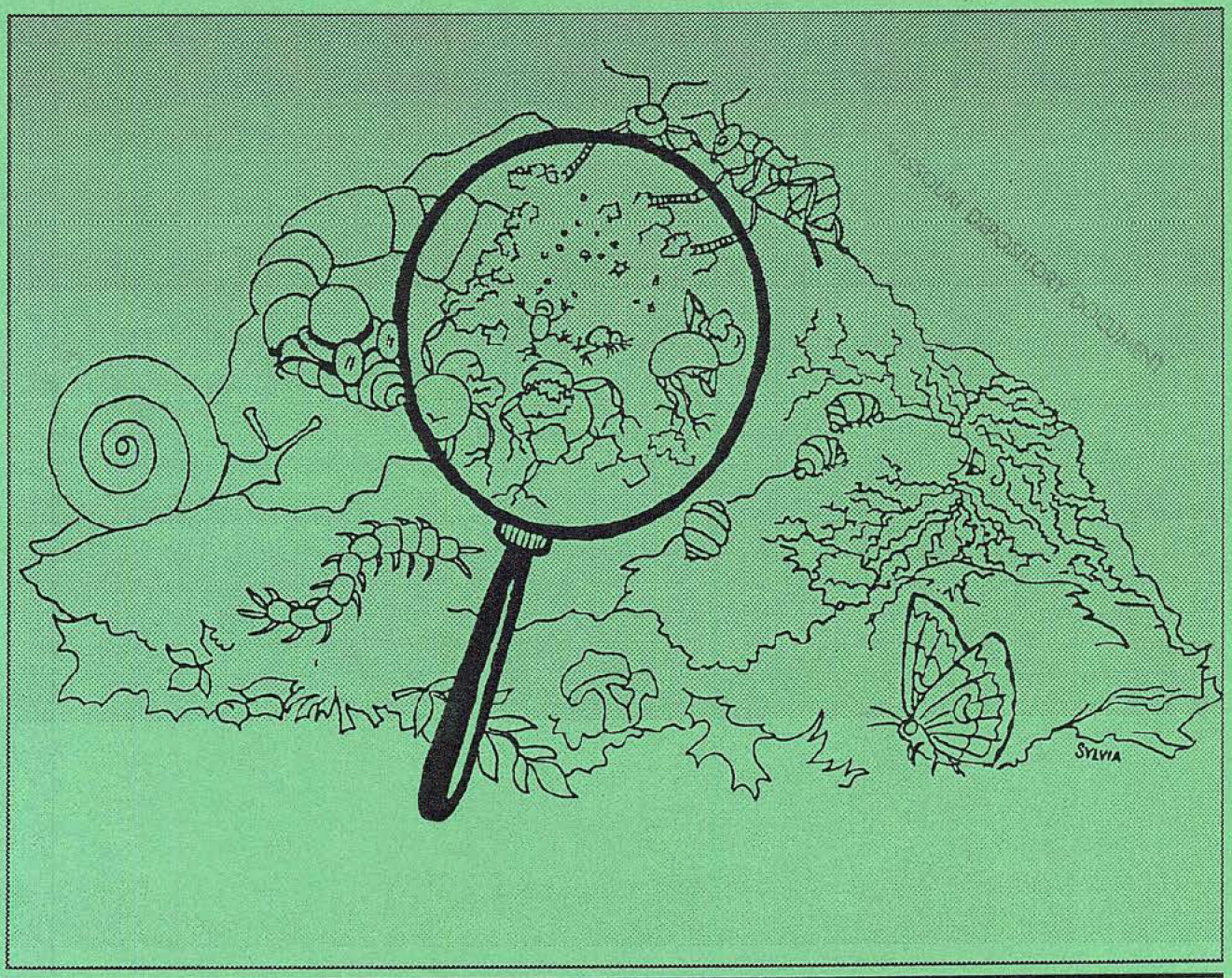
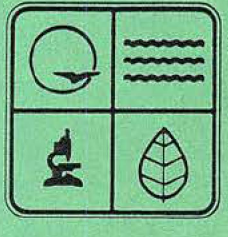
Grades 4-8
Teacher's Guide

Compost Learning Guide





Developed by The Composters Project
in cooperation with
Missouri Department of Natural Resources

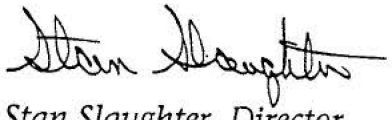
COMPOST LEARNING GUIDE

Introduction

This Compost Learning Guide is the result of a Solid Waste Reduction Grant received by ***The Composters*** *from the Missouri Department of Natural Resources.* ***The Composters*** *is an innovative, multi-disciplinary educational program developed in response to Missouri's statewide law which bans yard waste in landfills. For two years prior to receiving this grant,* ***The Composters*** *has been developing programs and teaching regionally.*

The goal of this Learning Guide is to provide teachers with a series of lessons to supplement the environmental curriculum. The grade level for the material is approximately 4th thru 8th grade. The Learning Guide's diverse activities offer you and your students the opportunity to take on a one-day composting activity or a year-long study of composting. Related activities help make each unit complete. My thanks to those who have helped put this guide together.

Happy Composting,



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April, 1994

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Recycled Paper

The History of Composting

The use of organic materials to replenish the soil is centuries old. The first mention of returning manures to the soil is from the oldest writings in the world, clay tablets of the Akkadian Empire. The Romans knew of compost; they applied rotted manures to the soil. The Greeks and Early Hebrews had words for compost and Luke 13:8 has an account of manuring fig trees. The Arab Book of Agriculture describes processing and use of compost, and sets out fertilizer values for crushed bones, wool scraps, wood ashes and lime. The Middle Ages have many accounts of composting and good agricultural practices. American President James Madison on May 12, 1818 said, in an address to an agricultural society in Virginia, "...The most logical mode of preserving the richness and of enriching a farm is certainly that of applying a sufficiency of manure and vegetable matter in a decomposed state."[1]

Modern composting was first described by Sir Albert Howard, working in India from 1905-1934. He experimented with layers of materials and devised what is now called the Indore method after the town of the same name. Today composting is an integral part of many gardens and an important waste reduction method.

Why Study Composting?

There are several compelling reasons to study composting. First, living things use carbon atoms as basic building blocks. When they die, these same building blocks are taken apart in order to be reused. Decomposition and composting deal with the breakdown process. Most of us are more aware of the growth side of this "carbon cycle," but the breakdown side is equally important.

Second, organic waste recycling is and will be an important part of waste control strategies, from homes to businesses to cities. Counting yard trimmings, brush, food scraps and waste paper, composting can reduce the trash stream up to 40%. Developing compost literacy is building good 21st century citizenship.

Third, composting is a great opening to such topics as recycling, ecology, food production, and soil fertility. Another advantage is that kids usually find the study of compost fascinating.

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1 *The Complete Book of Composting,* Rodale Press, Emmaus, PA p. 17

I. The Composters

Introduction

This section introduces the group of nature's recyclers called *The Composters*. The activities will suggest ways to make their valuable work more familiar.

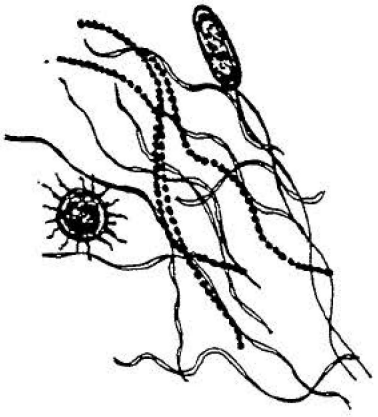
In nature, *everything* is recycled. Nutrients that fuel the growth of plants and animals are used, transformed, and then discarded. Bodies of plants, animals and their excreted materials are all used as resources by other organisms. The waste of one is food for another. By experiencing composting, students can gain an understanding of the nutrient cycle.

Just as living things grow and develop, they are disassembled when their life ends. The decomposition process is one of breaking something down into its component parts. Many kinds of simple, microscopic organisms feed on dead animals or plants; taking what they need and leaving the remainder, possibly becoming food for others in the process. The decaying material undergoes a step-by-step degradation, usually resulting in rich, dark humus added to the soil.

Vocabulary

Bacteria ***(bak-TEER-ee-ah)***

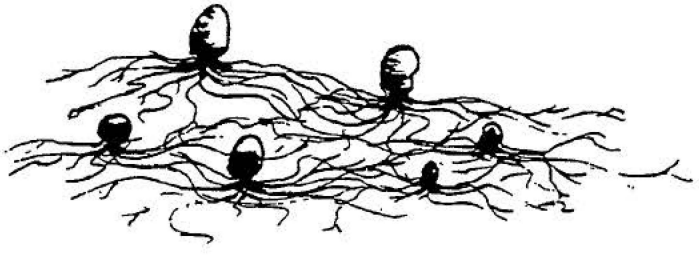
Bacteria are simple microscopic organisms that start the decomposition process and are by far the most numerous of the composting organisms. Young people are often fascinated by their hard-to-imagine size. Although bacteria have no heads, arms or eyes, they reproduce huge populations that can generate high temperatures. Compost works best in the range of 110-140° Fahrenheit. This heat is produced



and maintained by the rapid activity of untold billions of bacteria.

Fungi ***(FUN•jie)***

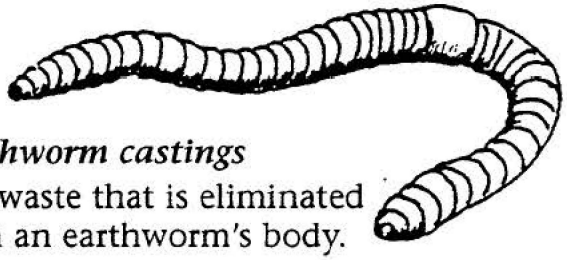
Molds, mushrooms and other fungi are simple plant-like organisms made up of a network of root-like structures. These primitive roots make up a mycelium (network) that dissolves and collects nutrients. The mycelium grows and develops, spreading its "fingers"



throughout the compost. When two mycelia meet, they can form a fruiting body. A fruiting body contains spores which produce the next generation. Mushrooms are examples of fruiting bodies.

Actinomycetes (ak-tin-oh-MY-seets)
Actinomycetes are small organisms that have properties of both fungi and bacteria. They perform a role similar to that of the bacteria in a compost pile. Several antibiotics are derived from actinomycetes.

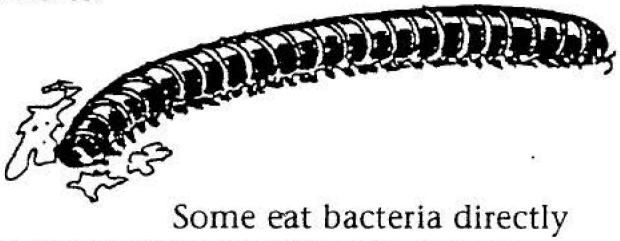
Earthworms (ERTH-wermz)
Earthworms come into the picture as the compost becomes more soil-like. Their role is to enrich the humus, by passing the almost-finished compost through their bodies and leaving behind their castings which enrich the soil.



Earthworm castings
The waste that is eliminated from an earthworm's body.

Arthropods (AR-throw-podz)

Arthropods are larger and more complex than the bacteria or molds. The word arthropod means jointed feet. They come in many shapes and sizes and have many different roles.



Some eat bacteria directly and are smaller than the eye can see. Others are relative giants, such as beetles or praying mantises.

Humus (HEWM-us)
Decomposed material in the soil that was once alive.

Many other kinds of organisms are involved in the composting process. Although we cannot know all of their names or their exact roles, we can study the miraculous transformation that they perform. We can speed the process by providing good conditions for *The Composters* to work, but the result is always the same. The humus in our soils is testament to the thousands of years they have been on the job.

Activities

A. Finding The Composters

Take a field trip on school grounds. Have each student find one example of something in nature that is evidence of *The Composters* in action. A partially decomposed leaf, the soft core of a rotting log, a mold or fungus growing on a stick, are all good examples.

Where to look for *The Composters*:

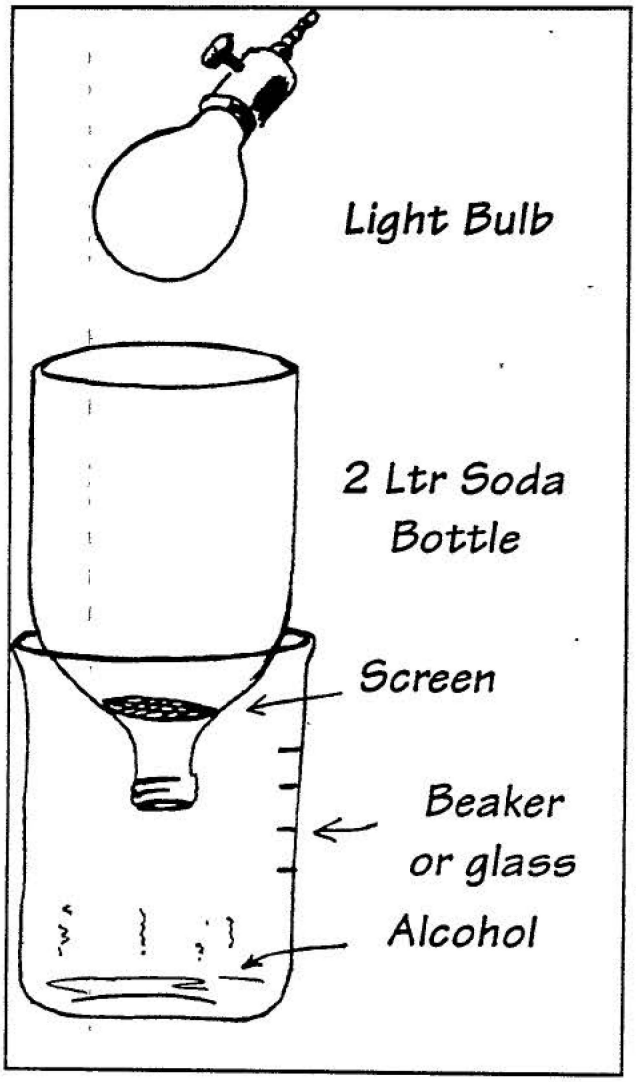
1. In the woods
2. Under a log
3. In the garden
4. In the top layers of soil

Try to find all the stages in a leaf's return to the soil.

B. The Big Guys

Gather a sample of leaf litter from the woods. Include everything from the top leaves to the first inch of soil. Box or bag the sample so that the small animals in the sample cannot get out. Make a funnel from a two-liter bottle (see illustration). Remove the lower two-thirds of the bottle and add a piece of window screen to the funnel to keep the sample from spilling. Place the sample in the funnel. Place the funnel in a beaker or jar that contains rubbing

alcohol. The lower half of the two-liter bottle may also be used for the container. Shine a strong light above the



funnel as shown in the illustration. Over a two-day period, examine the dish for small animals which are driven out of the sample by light and heat. List and draw pictures of the animals you find. Try different samples.

C. Looking for Humus

Dig small holes in the ground to examine the layering of the soil. Soil profiles are one way to understand the fertility and make-up of the soil in your area. Look for road cuts and excavations that expose soil profiles for you. Compare the relative richness of the topsoils by noting the relative darkness and crumbly nature of the soil. Usually, the darker the soil, the more living things, usually bacteria, that live there. Clay in a soil tends to make it clump when squeezed. Soils with high amounts of compost/organic matter tend to remain crumbly. Test different soils you find. What kinds of soils do you have?

Extension Activities

Meeting the Molds*

Place moist bread or fruit in an open container. In a few days to a week you should see mold start to grow. Watch it, describe it, and tell about the conditions it needs. Try this experiment under different conditions, comparing the results of light and dark, warm and cold conditions.

* Find out about students with allergies to mold before beginning this activity.

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Appelhof, Mary. ***Worms Eat My Garbage***. Flower Press. Kalamazoo, MI 49002

Appelhof, Mary. ***Worms Eat Our Garbage***, a children's activity book, available from Flowerfield Enterprises, 10332 Shaver Rd., Kalamazoo, MI 49002.

Hansen, Dennis. ***Vermicomposting: Innovative Kitchen Help***. Missouri Resource Review. 10(3):31-32. 1993.

Lavies, Bianca. ***Compost Critters***. Dutton's Children's Books, New York. 1993.

Further Information

Contact your local office of the Soil Conservation Service. They have information on soil profiles and the soil types in your area.

NOTES:

II. The Banana Breakdown

Introduction

The aim of the Banana Breakdown is to have students experience the decomposition of an easily composted material. This basic experience can lead them into more activities in this field.

Banana peels are readily compostable. Such food scraps represent about 7% of the trash stream in many locations. In general, food scraps decompose readily and they provide the high nitrogen levels we need to compost large amounts of leaves. When disposed of in a landfill, food scraps are among the first materials to decompose, adding to methane production. Decomposition is performed mostly by bacteria. By performing the suggested activities, students can begin to understand the conditions bacteria need to do their work.

Vocabulary

Aerobic (eh-ROH-bik)
A process, like breathing, that requires oxygen.

Anaerobic (AN-eh-roh-bik)
A process that proceeds in the relative absence of oxygen.

"Browns"
Sources of carbohydrates -- energy food for the compost. Usually leaves, stems of plants; mostly dry material.

"Greens"
Sources of protein, used in building up the number of living things in the pile. Grass clippings, food scraps, and manures are our most common "greens". They are usually moist materials.

Carbon (KAR-bun)
An element that takes many forms. Diamond, coal, and things like wood are mostly carbon. Carbon is the building block of all living things.

Nitrogen (NIE-troh-jun)
An element necessary for life. Nitrogen's unique structure helps it to form amino acids which build into proteins. Proteins are essential to build the muscles and sinews of living things. Adding nitrogen-rich "greens" material to a compost pile allows the living things in the pile to multiply and incorporate the new nitrogen into more living things. This accelerates the decomposition rate.

Methane (MEHTH-ain)
A natural gas produced by anaerobic decomposition occurring in swamp muck and the intestines of animals, especially termites. Natural gas, as a fuel, is used to heat homes and water and to cook food.

Activities

Explain to the students that every living thing will eventually return to the soil. Some things return (decompose, compost) faster than others. The five trials in this activity -- Water, Soil, Sun, With Air, and Without Air -- will help them determine what conditions help or hinder decomposition.

Materials

1. Five equal pieces of banana peel (about 1-inch square)
2. Ten small sealable containers, such as baby food jars or Zip-loc bags
3. Water
4. Moist garden soil
5. Dark place
6. Lighted place
7. Plastic wrap (about 4 inches square)

Procedure

1. Set up the five trials.

Trial 1. WATER
Place the peel in the jar. Add enough water to the jar to cover the peel. Seal the jar.

Trial 2. SOIL
Fill the jar with soil so that the peel remains visible on one side of the glass. Put the lid on the jar.

Trial 3. SUN
Insert the peel, seal the jar, and place in a sunny spot.

Trial 4. WITH AIR
Insert the peel, leave the lid off.

Trial 5. WITHOUT AIR
Wrap the peel with a piece of thin plastic, tape the package closed, place it in the jar and replace the lid tightly.

2. Place all the jars except "Trial 3: Sun" in a dark place.

3. At the end of one week, observe all the jars, but don't open them.
   a. Has the color changed?
   b. Texture?
   c. What else do you observe?

4. Record your observations on the Records Chart on the next page.

5. At the end of the second week, record the observations again. You may wish to open some of the jars to observe further. Decide with the students which, if any, trials to continue. What conclusions can you draw about the needs of bacteria?

Questions

1. Did the peels change in the same way?
2. Which trials changed the most?
3. Did any stay exactly the same?
4. Are there other combinations of factors you would like to try? Write your own experiment to test them.

Extension Activities

1. Examine the trash from the cafeteria. Is the food and compostable paper being separated? Could some of the food scraps be used in a compost pile on school grounds or as a small test in the classroom? Are there other materials besides bananas that you could test?

2. Try another test with finely chopped banana peel. Repeat the trials above or design some of your own.

3. Finely chop or blend a small quantity of materials from one of the recipes on page 23 and test it with the trials above.

Field Trips

1. Visit a farmer's market. Find out where the spoiled vegetables go. Try to estimate the volume of the material that could be recovered.

2. Check out the volumes of food scraps from several types of restaurants.

Recording Chart for Banana Breakdown

Trial	Time	Color	Texture	Description
1. Water	1 week later			
2. Soil	1 week later			
3. Sun	1 week later			
4. Air	1 week later			
5. No Air	1 week later			

Comments:

NOTES:

III. Something Rottin' Inside

Introduction

Working compost piles can fascinate and amaze students as "raw" organic materials become stabilized compost. A compost pile works best when there is a large volume of materials to sustain a reasonable reaction rate. Small baggies or two-liter bottles of compost do not behave as a full size pile does. First, they are too small to retain heat. In a large pile, the outer edges act as insulation, thus keeping a "core" area warm. Second, maintaining the proper moisture content can be difficult, with rapid drying or putrid mush as common outcomes.

This activity, Something Rottin' Inside, uses a five-gallon plastic bucket as a container and thereby prevents some of the problems described above. The buckets are usually easy to find and can be prepared with little effort.

Vocabulary

Compost (KAHM-pohst)
Rich organic material produced by the action of millions of microbes.

Inoculant (In-NAHK-you-lunt)
An ingredient that increases the numbers of bacteria and other organisms. An inoculant can help a pile get started rapidly. Soil or commercial products can be used as inoculants.

Activities

Materials

1. One or more four- to five-gallon plastic buckets with lid. Provide a method, if necessary, to seal the pour spout in the lid.

2. A suitable 1-quart volume measure.

3. An insulating blanket to completely wrap the bucket (an old Army blanket?).

4. 1/2-quart of garden soil or well-rotted compost (inoculant).

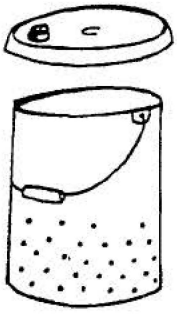
5. 8-quarts fresh vegetable matter (grass clippings, food scraps).

6. 10-quarts brown, dry vegetable matter-(chopped leaves, old hay, shredded paper).

7. pH test paper, preferably of the type that yields a range of values.

8. An oven meat thermometer (*not* to be reused later for cooking) or a lab thermometer taped to a stick.

9. Bathroom scales to weigh the bucket.



Procedure

A. Preparing the bucket

1. Drill 10 to 15 small (1/4"-1/2") holes in the lower sides of the bucket (not the bottom), drilling no closer than 1" to the bottom of the bucket.

B. Preparing the compost

1. Weigh the bucket empty using the bathroom scales

2. Gather a mix of materials to be composted (See Recipes, p.23.)

3. Chop the vegetable and leaf material as small as possible. Have the students shred the leaves by hand. Ask them to notice the fibrous nature of the leaves.

4. Mix and moisten all the ingredients well. (Set aside a sample of the water

for pH testing. See Part C1.)

5. Fill the bucket without packing it. Weigh it, put the lid on loosely and wrap the bucket with the blanket.

6. Let the bucket sit for about two weeks (may be kept outside). As larger pieces of green matter decompose, they may produce an unpleasant odor until the process gets under way. Any odor should not persist past 3-4 days.

C. The Carbon Dioxide Test

1. Test the pH of the water used to moisten the compost.

2. Leave the stopper or lid off the compost bucket for several days to allow the compost to breathe. Use the pH tape to test any moisture that collects under the lid or on the spout. Notice any odor or heat. Record your observations in the comments section on the Compost Recording Chart (p. 15).

3. Seal the lid and wait several days.

4. Open the lid and test the pH of any liquids you find on the lid or spout. The test tape should indicate an acid condition due to carbon dioxide dissolved in the moisture. Record the results on the Compost Recording Chart (p. 15).

D. Heat, Volume Reduction, Weight, Visual Observation

1. Measure the height of the compost in the bucket and record.

2. Wrap the bucket to hold any heat produced.

3. Record the temperature and weight daily.

4. Record visual data on the compost daily.

5. After some time (variable, four weeks perhaps) there will be no further changes. Dig and mix the ingredients thoroughly. Record any changes in the materials. If the materials have not yet composted, (not yet rich, dark and crumbly) then you probably should add more fresh, green organic material. Mix these materials in well. Record the additions on the Compost Recording Chart (p. 15). Resume the observation.

Questions and Answers

1. Why does the volume shrink?
(Compaction, change in texture and density.)

2. Did the pH tape show an acid result?
(Carbonic acid is formed when the carbon dioxide dissolves in water.)

3. Did the mass of the bucket change? Why or why not?
(Carbon dioxide and moisture are lost from the pile.)

4. Did the heat subside? Why?
(Nitrogen sources were limited, "the microbes ran out of building blocks", better aeration was needed.)

5. How is this process like baking a cake?
(Mixing ingredients, using a recipe, heat is involved, there is a change in texture.)

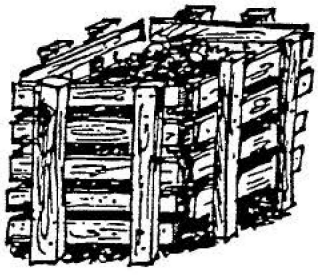
6. Ask the students to comment on the larger role of decomposition in the natural world of a forest, for example.

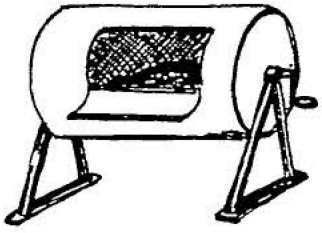
7. Ask the students to comment on composting as a means of disposing of many kinds of organic wastes.
(Saves landfill space and reduces pollution, and produces valuable soil conditioner.)

8. Research composting toilets. How do

they work? Why do people use them? (To save water, water is not available for flushing, to protect sensitive environments, because a sewer or septic tank cannot be used.)

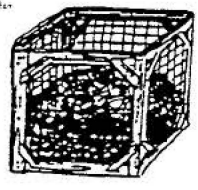
9. Ask the students to describe a world in which decomposition does not occur.

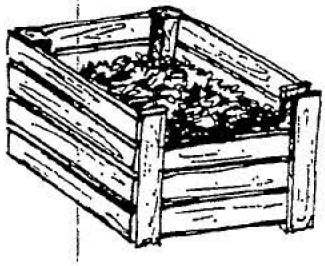


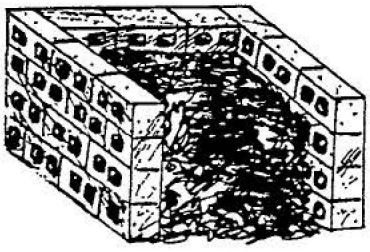


Extension Activities

Build a full-size compost pile out of doors, using one of the designs pictured.Compost bins on school grounds are a great way to illustrate the composting process. They are easily managed; they tolerate neglect well and they give the students a good example to follow at home. Make sure that you involve the administration in approving the site and design of your bin. Compost piles are rarely vandalized and can be an attractive addition to the school's landscaping. Composting food waste should be done carefully, and only after checking for any city or county ordinances that may prohibit food waste composting. Food waste is problematic in that it can draw animals and cause odors. For these reasons, limit the amount of food waste and bury it well within the pile.







After two or three turnings and three to six months, the compost will be ready.

The finished material can be used in the school garden, added under shrubs, or sprinkled lightly on a section of lawn.

References

1. ***Backyard Composting*** Harmonious Press, PO Box 1865-100, Ojai, CA 93024. Call 1-800-345-0096 to order; bulk rates available.
ISBN 0-9629768-0-6 CIP 91-073105.

2. Campbell, Stu. ***Let It Rot!*** Garden Way Publications, Charlotte, VT. 1990. 631.875, C19L.

3. For bin design sheets, contact: Mo. Dept of Natural Resources, PO Box 180, Jefferson City, MO 65102-0180.

Field Trips

1. Visit the local landfill. Ask the operator about the seasons for yard trimmings and how they are handled.

2. Visit a local farm or zoo; find out how they handle their manure.

3. Visit a large-scale composting operation, if possible.

Further Information

1. Call your regional office of the EPA and inquire about materials on composting yard waste or municipal solid waste. EPA, Region 7, phone number: 913-551-7050 (a Kansas City metro area phone number)

2. The Mo. Dept. of Natural Resources also has materials about these issues. Contact: Mo. Dept. of Natural Resources, Solid Waste Division, PO Box 180, Jefferson City, MO 65102-0180.

Compost Recording Chart

Name	Batch number or name	Type and size of enclosure

Date Started: _____

Type and amount of "brown" material used	Type and amount of "green" material used	Water added (describe moisture content)	Starting Volume (may be height only)

	1st check/ turning	2nd check / turning	3rd Check/ turning	Results
Date				
Temperature				
Additions				
Comments				

NOTES:

IV. Hold the Water

(Demonstration or Group Experiment)

Introduction

Most soils contain organic matter. Organic material has important effects in the soil. This activity, *Hold the Water*, will introduce and examine effects of organic matter in the soil. One benefit of compost is its ability to break up heavy clay soils by aggregating clay particles. Aggregation improves the clay's drainage and mineral exchange. Extra organic matter in sandy or clay soils also holds water longer reducing the soil's need for irrigation. These two properties of organic matter seem contradictory, but in fact they are just two of the benefits of rich soils. In the midwest, topsoil is produced at the rate of one inch every 300-1,000 years. The hard-to-replace nature of our topsoils makes valuing and protecting them very important.

Vocabulary

Humus (HEWM-us)
Organic matter in the soil; the remains of living things. Usually associated with a dark rich color in the soil.

Soil profile (soyl proh-file)
Layers of soil from top to bottom, grass or rock.

Clumping or Aggregation (ag-ree-GAY-shun)
The action of compost on clay soils, causing them to form small particles or clumps. This breaks up the slick texture, allowing more movement of water and nutrients.

Activities

Tell the students they are going to test the compost's ability to improve drainage in clay soils and to retard drainage in sandy soils. They will measure the amounts of water that pass through different soil samples they create. Students record and compare their results.

Materials

1. 1 quart sand.

2. 1 quart garden soil.

3. 1 quart clay (from a road cut or other local source).

4. 1 quart compost (homemade compost should be sifted to produce a uniform texture).

5. Two filter funnels with support stands. Make a funnel from 2-liter bottles (see illustration). The bottom of the two-liter bottle can be used as a base.

6. Folded paper towels or coffee filters.

7. 50-milliliter graduated cylinder (or other appropriate measuring device).

8. Measuring cups (1 cup and 1/2 cup).

Procedure

Trial 1.

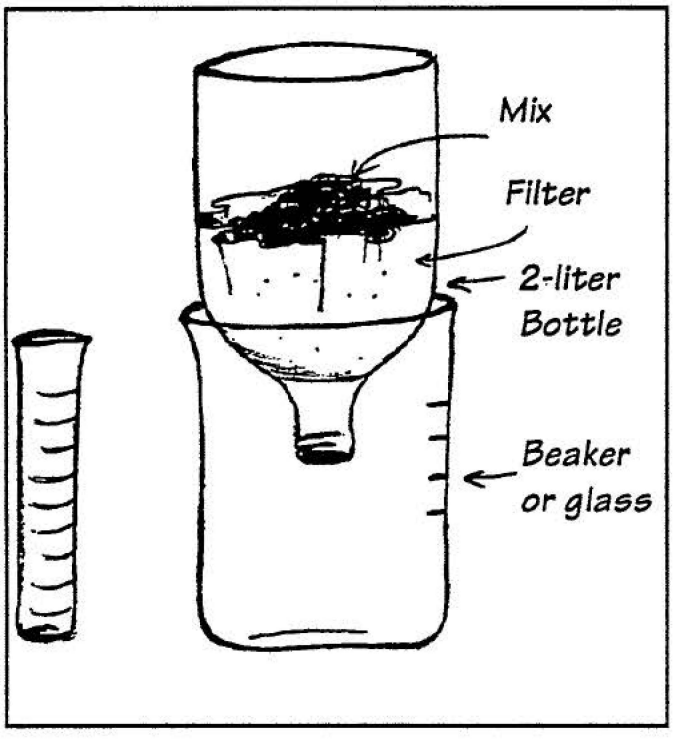
1. Mix 2 cups garden soil with 2 cups of sand.

2. Divide this sample in half.

3. To one half of the sample, add 1/2 cup of compost and mix thoroughly.

4. Place a 1/2 cup sample of each type of soil on a filter.

5. Place the filters in the funnels.



6. Pour a measured amount of water (try one cup) through each sample (be sure to evenly wet each sample) and collect the water that comes through.

7. Measure and compare the amounts of water.

8. Note the color and clarity of the collected water.

9. Allow the filtered water to settle. Describe the sediment, if any.

10. Complete the Records Chart on page CD.

Trial 2.

1. Mix 1/2 cup of clay with 2 cups of garden soil.

2. Divide the sample in half.

3. To one half of the sample, add 1/2 cup of compost and mix well.

4. Repeat steps 4-8.

Questions and Answers

1. What was the effect of the compost?
(Retained water and improved drainage.)

2. How would it be beneficial in both cases?
(Good drainage and drought resistance are important characteristics.)

3. What would farming clay be like?
(Hard when dry, slick and sticky when wet.)

4. What would happen to a rain that fell on a clay soil?
(High percent of the rain would run off.)

5. What would happen to a rain that fell on a sandy soil?
(Rain would quickly drain through.)

6. What is the effect of high clay content on water movement through the soil?
(On the surface, speeds it as run off; through the soil, movement is slowed.)

Extension Activities

1. Try comparing pure sand with sand plus two cups of compost.

2. Test the effect of more compost in each of the previous trials.

3. Try a test with pure clay.

4. Specially formulate several soils for a plant growth trial. Ask the children which combinations they would like to test.

5. Test a sample of a commercial potting soil.

6. Measure the water retained in each of your tests by weighing the samples before and after adding the water.

Field Trips

Contact a local Soil Conservation Agent and arrange to take a soils tour.

Sources

Contact your local Soil Conservation Service office.

Contact an Organic Growers Association. Ask what can be added to the soil locally to improve it.

Contact your state Department of Natural Resources. Ask what guidelines they recommend for the application of compost.

Read More About It

Farmers of Forty Centuries. F.H. King D.Sc. Rodale Press, Inc. Book Division. Emmaus, PA 18049

Recording Chart for "Hold The Water"

Trial	Water In	Water Out	Sediment	Color	Comments
1. Soil without Compost					
1a. Soil with Compost					
2. Clay and Soil w/o Compost					
2a. Clay, Soil & Compost					

Comments:

V. A Key to Good Compost

Carbon/Nitrogen Ratios

One of the main concepts in composting is how an ingredient will affect the mix. Dry, brown materials provide the fuel, the carbohydrates, that are the energy source needed by microbes (bacteria). Wet, green materials provide the protein, the building blocks, needed to increase the population of living organisms within the pile. There must be a balance between the greens and the browns. Too much green will provide an excess of nitrogen which cannot be used and will usually cause a bad smell. Too much brown signals an over abundance of carbon; the pile will suffer from "protein deficiency" and decomposition will proceed slowly. The rate will be slow because the microbes (bacteria) need protein to reproduce more of themselves. A larger population can decompose or "consume" the pile faster.

The balance between carbon and nitrogen is known as the Carbon/Nitrogen ratio. Each material has its own ratio which labels it as either a source of nitrogen or a source of carbon. Usually materials with a ratio lower than 30:1 are sources of nitrogen. 30:1 means 30 atoms of carbon for every one of nitrogen. Materials with ratios above 30:1 are considered sources of carbon. Dry pine sawdust, for example, burns readily and has a ratio of 500:1, definitely a source of carbon. It would take a long time to decompose a pile of sawdust. Leaves can vary from 50-90:1 and break down much faster than sawdust. Fresh manure has a ratio of from 8-15:1 and is, as you would expect, a strong source of nitrogen.

Building an efficient and fast-working pile means mixing greens and browns to achieve a starting ratio of about 30:1. During the composting process much of the carbon in the pile is consumed ("eaten") and breathed into the air by the microbes. This lowers the final ratio in finished compost to the area of about 20:1.

As the saying goes, Compost Happens. All we can do is affect the rate at which it happens. Even giant piles of sawdust eventually become rich brown humus. You may wish to build an active, fast working, pile or a slow moldering pile. Composting is not a race and there are no penalties for finishing last. Being aware of the Carbon/Nitrogen ratio and the state of your pile will put you in control of the process and allow you to decide how fast your compost happens.

Table of Carbon/Nitrogen Ratios

Material	C/N Ratio
Urine	0.8:1
Blood	3.0:1
Human feces	6-10.0:1
Fresh Grass Clippings	12.0:1
Tomatoes	12.0:1
Average barnyard manure	14.0:1
Horse Manure	18.0:1
Red Clover	27.0:1
Fern	43.0:1
Oat straw	48.0:1
Timothy Hay	58.0:1
Leaves(average)	70.0:1
Wheat straw	128.0:1
Rotted sawdust	208.0:1
Raw sawdust	511.0:1

Table modified from Gotaas, *Composting* p.44; as found in Stoner, *Goodbye to the Flush Toilet,* p. 48.

Recipes

Composting can be viewed a little like cooking; a good recipe will enhance the finished product. The following recipes and ratios are suggestions for combinations you can create from the materials you have available.

A compost pile made up of one fourth to one half high-nitrogen materials (greens) will heat up rapidly and become compost faster.

COMPOST COOKBOOK

RECIPE #1

2 parts	Dry leaves	CC	Browns
2 parts	Straw/wood shavings	CCC	Browns
1 part	Manure	NNN	Greens
1 part	Grass clippings	NN	Greens
1 part	Fresh garden weeds	N	Greens
1 part	Food scraps	NN	Greens

RECIPE #2

3 parts	Dry leaves	CC	Browns
1 part	Fresh garden weeds	N	Greens
1 part	Fresh grass clippings	NN	Greens
1 part	Food scraps	NN	Greens

RECIPE #3

6 parts	Dry leaves	CC	Browns
3 parts	Food scraps	NN	Greens
3 parts	Fresh grass clippings	NN	Greens

RECIPE #4

3 parts	Dry leaves	CC	Browns
3 parts	Fresh grass clippings	NN	Greens

RECIPE #5

3 parts	Dry grass clippings	C	Browns
3 parts	Fresh grass clippings	NN	Greens

N = nitrogen	C = carbon
NN = higher nitrogen	CC = higher carbon
NNN = highest nitrogen	CCC = highest carbon

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